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Movement patterns and site utilization of fishes as determined by acoustic telemetry: implications for the design of marine reserves

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Summary

Marine reserves (MRs), also known as no-take reserves, represent one of the primary tools for conservation and management of the marine environment currently available to managers. While the theoretical justification for MRs is extensive (see National Research Council 2001), and mounting evidence demonstrates the effectiveness of MRs as a management tool (Halpern, 2003), empirical data on the utility of MRs for mobile taxa such as fishes is still needed (Lindholm and Auster, 2002). Information on the movement of individual fish relative to landscape features, in both tropical and temperate seas, is critical for the design of successful MRs. A number of studies have demonstrated that many fish species exhibit statistically significant but facultative associations at various life history stages with specific microtopographic structures (=microhabitats) in low topography environments (e.g., Auster et al. 2003; Auster et al. In Press). Less is known, however, about the movement patterns and site utilization of individual fish relative to these features of the landscape.

Whether the goal of an MR is the protection of the diversity of fishes overall (Bohnsack and Ault, 1996; Agardy, 1999; Hastings and Botsford, 2003) or the management of particular exploited fish populations (Bohnsack, 1993; Dayton et al., 2000; Gell and Roberts, 2003), the siting and design of MRs will be improved by data on the movement of fishes of different species relative to landscape features and patterns. Results are presented for two on-going telemetry studies in the western North Atlantic: Stellwagen Bank National Marine Sanctuary (SBNMS) in the Gulf of Maine and in the northern Florida Keys.

At SBNMS, site utilization by Atlantic cod (*Gadus morhua*) in gravel habitat and piled boulder reefs was quantified throughout the summers of 2001 and 2002. At the Florida Keys National Marine Sanctuary (FKNMS), acoustic receivers were first deployed on the seafloor at five sites extending

across Pickles, Conch and Davis reefs in November 2001. Site utilization and movement between sites was quantified for Yellow tail snapper (*Ocyurus chrysurus*) and black grouper (*Mycteroperca bonaci*) tagged with coded, acoustic pingers. In August and December 2002, the receiver array was expanded to include 27 sites and an additional 90 fish were tagged from a variety of fish species.

In the Gulf of Maine Lindholm and Auster (2003) showed that more than 1/3 of the benthopelagic Atlantic cod tagged with acoustic pingers showed high site fidelity to pebble/cobble habitat. Though the movement behavior of individual fish varied considerably, 37% of the tagged cod were present within an area of 0.5 km² for more than 80% of their time at large (4 months). Observed cod site fidelity increased significantly over piled boulder reef features, where more than 50% of the cod showed strong site attachment to particular reefs over a similar period (Lindholm and Auster, in prep). In the upper Florida Keys, site fidelity of yellowtail snapper and black grouper was quantified within the Conch Reef Research Only Area (Lindholm et al., in review). Individual fish from both species showed strong site attachment to the landscape within the reserve.

These results underscore the importance of working from actual data rather than speculation: each of the fish species tagged moved much less than expected.

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